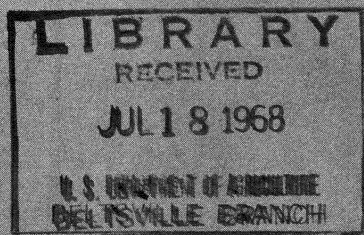
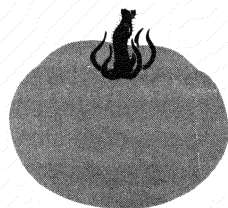
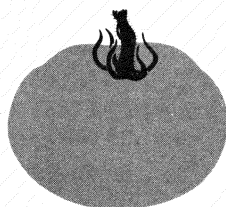
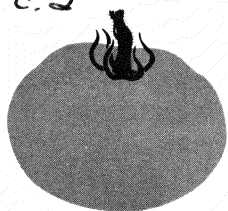


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CONTROLLING
tomato
diseases

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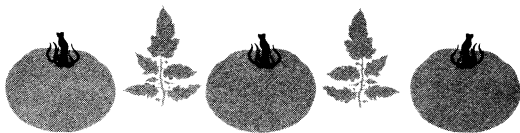
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CONTROLLING *tomato diseases*



Some diseases that commonly affect tomatoes are fusarium wilt, verticillium wilt, damping-off, septoria leaf spot, gray leaf spot, early blight, late blight, bacterial spot, anthracnose, soil rot, blossom-end rot, and tobacco (tomato) mosaic.

Other disorders that commonly affect tomatoes are catface and 2,4-D injury.

Following are ways in which you can prevent or reduce losses from disease:

- Plant resistant varieties if they are available.
- Treat seed with a fungicide.
- Apply fungicides to foliage and fruit.
- Rotate crops.

DISEASES

Fusarium Wilt

Fusarium wilt attacks tomato plants in many regions of the United States. The first symptom of this disease is yellowing of the lower leaves. The yellowed leaves gradually wilt and die. As the disease progresses, yellowing and wilting continue up the stem until the

foliage is killed and the plant dies (fig. 1). The stem shows no soft decay, but the woody tissue under the outer (green) stem turns dark brown.

Control.—Plant resistant varieties (see p. 7).

Verticillium Wilt

Verticillium wilt causes serious losses of tomato plants in some sections of California and Utah. Since 1959 losses have been severe in some North Central and Northeastern States. This disease is rare in the South, except in the Homestead area of Florida.

First symptoms appear on leaves at the bottom of the plant. These leaves turn yellow, gradually wither, and fall. Leaves higher on the stem become dull in color, and leaflets may curl upward. As the disease progresses in the plant, only leaves near the tips of branches remain alive. All branches may be affected and they are less erect than branches on healthy plants.

Control.—Plant resistant varieties (see p. 7).

Damping-Off

Damping-off is a soilborne disease that is distributed throughout the United States. It causes decay of seed or seedlings in the soil, or causes young plants to collapse and die (fig. 2).

Control.—Treat seed (see p. 3).

Septoria Leaf Spot

Septoria leaf spot is most prevalent in the Middle Atlantic and North Central States, and frequently occurs as far south as Arkansas and South Carolina. It is of minor importance in the Deep South, the Mountain States, and the Pacific States.

Septoria leaf spot is one of the most destructive leaf diseases of tomato plants. It occasionally attacks the stems and blossoms, but rarely attacks

the fruits. Infection usually occurs on the lower leaves of tomato plants after they begin to set fruit, but it may occur on young plants.

Infected leaves develop water-soaked spots. The spots are circular; they have gray centers and blackish borders. Tiny dark specks develop in the centers of the spots (fig. 3). If spotting is severe, the leaves eventually die and fall, and fruits are subject to sunscald.

Control.—Burn plant debris or bury it deeply during land preparation. Rotate crops. Control weeds. Apply a fungicide (see p. 8).

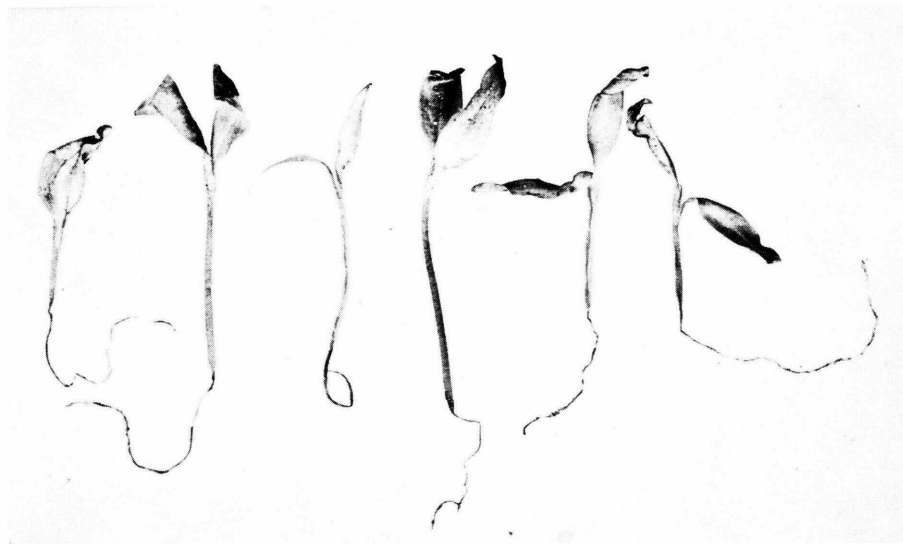
Gray Leaf Spot

Gray leaf spot is most prevalent in the Southern States. This disease does not infect the fruits of tomato plants.



Figure 1.—Tomato plant showing symptoms of fusarium wilt.

68001



1186

Figure 2.—Tomato seedlings affected with damping-off.

Infected leaves develop small dark-brown spots (fig. 4) that extend through to the undersides of the leaves. These spots enlarge, turn grayish brown, and become glazed. As the disease spreads, leaves turn yellow, wither, and fall. In warm, moist weather, gray leaf spot may kill all leaves except those near the tips of branches.

Control.—Apply a fungicide (see p. 8).

Early Blight

Early blight occurs to some extent in most tomato-growing regions. It is most common and serious in the New England, Atlantic, and Central States. This disease attacks the stems, leaves, and fruits of tomato plants.

Infected stems develop dark-brown cankers that may girdle plants at the soil line. Infected leaves show small, irregular, dark-brown spots, which

often enlarge into circular spots that have targetlike markings (fig. 5). The leaf tissues surrounding these spots usually turn yellow.

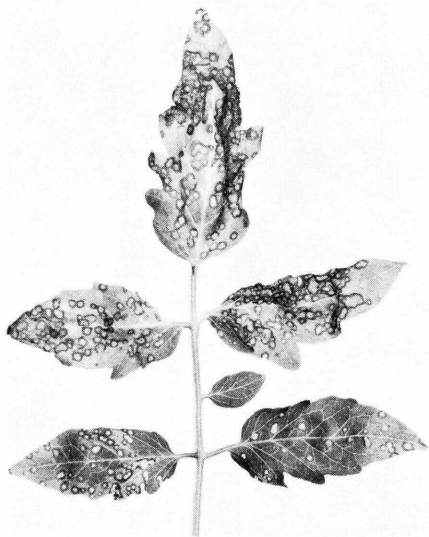
Dark, leathery, decayed spots appear on the stem end of fruits infected with early blight. These spots (fig. 6) enlarge and develop targetlike markings. The decay extends deep into the flesh of the fruit.

Control.—Apply a fungicide (see p. 8).

Late Blight

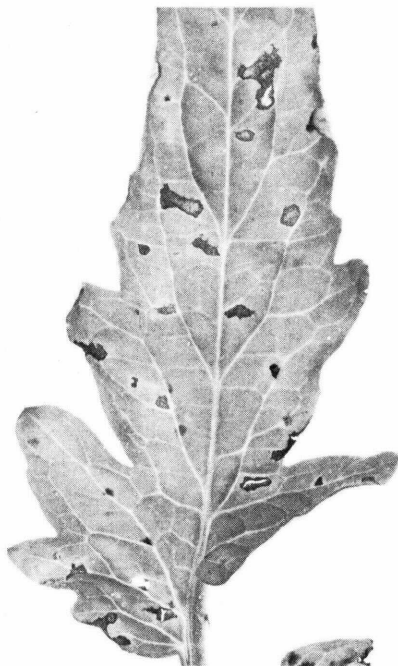
Late blight occurs in humid areas of the United States. It affects the leaves and fruits of tomato plants.

Leaves of infected plants first develop greenish-black, water-soaked blotches (fig. 7). The blotches enlarge rapidly. In moist weather a white, fuzzy growth develops on the undersides of the leaves, and infection spreads rapidly to



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Figure 3.—Tomato leaves showing symptoms of septoria leaf spot. Spots have dark borders and light centers with dark specks.



BN-25874

Figure 4.—Tomato leaf showing symptoms of gray leaf spot. Spots are small and irregularly shaped, and have a grayish-brown glazed appearance.

nearly all the leaves. The plants eventually wither and die.

Fruits of infected plants first develop a grayish-green, water-soaked spot. The spot becomes brown and wrinkled, and often covers half of the fruit (fig. 8). The border of the spot usually is slightly sunken. The infected tissue may develop a white fungus growth in moist weather.

Control.—Apply a fungicide (see p. 8).

Bacterial Spot

Bacterial spot most frequently occurs in the Southern, Central, and Middle Atlantic States. It is most prevalent during warm, rainy seasons. Bacterial spot affects the leaves, stems, and green fruits of tomato plants.

Infected leaves first show small, irregular, dark-green spots, which have a greasy appearance. The spotted tissues turn brownish black, eventually dry out, and frequently tear. Spotted leaves—even those having only a few spots—turn yellow and eventually fall.

Green tomatoes that are infected with bacterial spot first show tiny water-soaked spots. The spots enlarge, develop greenish-white borders, and become slightly raised (fig. 9). They eventually turn light brown and become sunken and scabby.

Control.—Treat seed with Ceresan M, and apply a fixed copper spray or dust (see p. 9).

Anthracnose

Anthracnose is a common and widely distributed rot of ripe tomatoes. It

does not cause serious losses where tomatoes are harvested green.

Infected tomatoes first show small water-soaked spots that are slightly sunken. The spots enlarge, darken, become more sunken, and often develop targetlike markings (fig. 10). The centers of the spots may turn tan and develop dark specks.

Spots may also appear on the lower leaves of plants that are infected with anthracnose. The spots are small and have brownish centers and yellow borders.

Control.—Treat seed with Ceresan M, and apply a fungicide (see p. 8).

Soil Rot

Soil rot frequently occurs when tomatoes are allowed to lie on the soil and when rain repeatedly splashes soil on them.

Infected tomatoes first develop a brown targetlike spot that is slightly sunken. The spot enlarges; its center becomes dark brown and frequently breaks open (fig. 11).

Control.—Grow tomatoes on well-drained soil. Stake tomato plants.

Blossom-End Rot

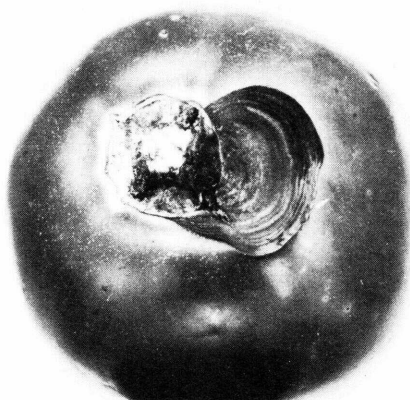
Blossom-end rot occurs to some extent wherever tomatoes are grown. A small water-soaked spot first develops at or near the blossom end of infected tomatoes. The spot (fig. 12) enlarges and darkens; it becomes sunken and leathery.

Blossom-end rot is most prevalent during prolonged dry periods that occur while the plants are making vigorous growth. It may also occur after periods of unusually abundant rain.



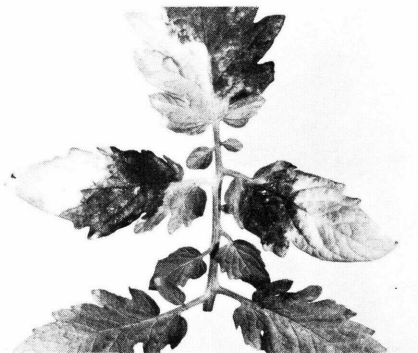
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Figure 5.—Tomato leaves showing symptoms of early blight. Note targetlike markings.



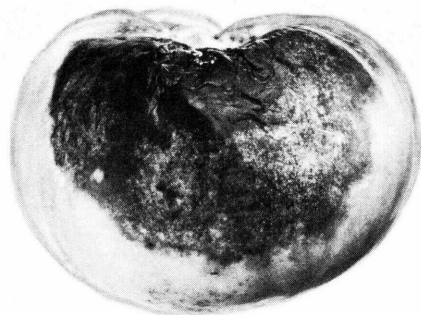
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Figure 6.—Tomato affected with early blight.



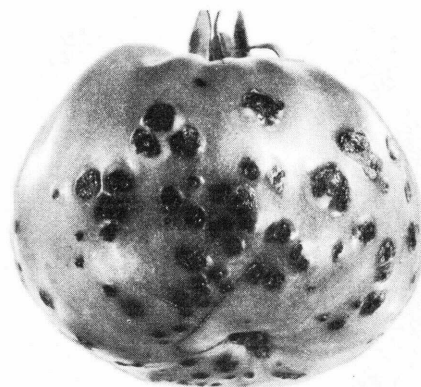
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Figure 7.—Tomato leaves showing dark blotches characteristic of late blight.



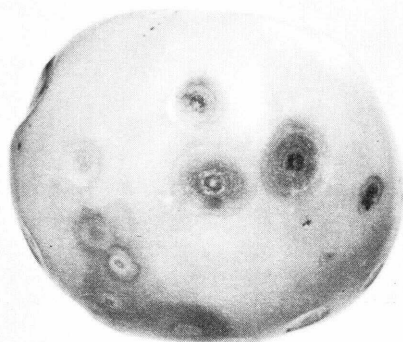
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Figure 8.—Green tomato affected with late blight. Note wrinkled tissue.



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Figure 9.—Tomato showing a late stage of bacterial spot. The spots are raised, but the centers are slightly sunken and have a rough, scabby appearance.



68014

Figure 10.—Tomato showing symptoms of anthracnose. Spots are sunken and have targetlike markings.

Heavy applications of nitrogen fertilizers and extreme fluctuations in moisture favor the disease.

Control.—Apply proper amounts of lime and superphosphate. Avoid excessive use of nitrogen fertilizers. Maintain an even supply of moisture for the plants through timely and thorough irrigation.

Catface

Catface occurs to some extent wherever tomatoes are grown. It affects the fruits. Affected fruits are malformed; they have cellular indentations (fig. 13) on their stem end.

The cause of catface is not fully understood, but some varieties of tomatoes are more subject to catface than others.

Control.—Grow locally recommended varieties.

2,4-D Injury

Leaves of tomato plants that are injured by 2,4-D (a herbicide) first curl downward. If the injury is severe, the leaves eventually roll and new growth is twisted (fig. 14). The main stem may split; small shoots may develop along the opening.

The fruits of plants injured by 2,4-D develop catface (fig. 13) and contain few, if any, seed.

Control.—Use low-volatile ester or amine salt formulations of 2,4-D for weed control. Avoid spraying on windy days. Use separate sprayers for herbicides, fungicides, and insecticides.

Tobacco (Tomato) Mosaic

Tobacco, or tomato, mosaic is common throughout the United States. It causes a yellow-green mottling on leaves and occasionally on fruit. Infected leaves are curled and slightly

malformed (fig. 15). Plants are stunted and fruit yields are reduced.

This disease is highly infectious. It is spread mainly by persons who handle plants.

Control.—No control, except sanitation. Avoid excessive handling of tomato seedlings. If you smoke, wash hands with soap and water before touching tomato plants; do not smoke while working with tomato plants.

CONTROL MEASURES

Planting Resistant Varieties

The planting of disease-resistant varieties is the most effective way to control some of the diseases caused by organisms living in the soil. Major soilborne diseases and varieties that will resist them are as follows:

Fusarium Wilt

Floralou	Manapal
Floradel	Marion
Homestead	Nemared
Kokomo	Louisiana Red Global
Delsher	Roma (paste)
Manalucie	Chico (paste)

Verticillium Wilt

Galaxy	West Virginia 63
Redtop VR-9	VR Moscow

Fusarium and Verticillium Wilts

Porte	Pearson VF-6
Heinz 1350	Pearson VF-11
Campbell 1327	Roma VF (paste)
Enterpriser	Harvester (paste)

Early Blight

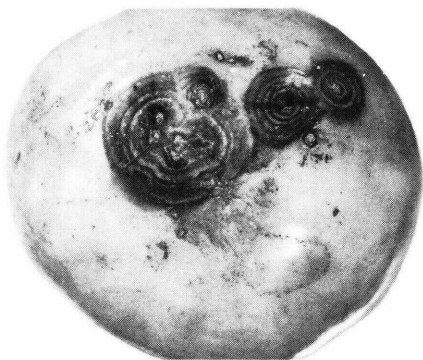
Floradel	Manalucie
Immokalee	New Hampshire Surecrop

Gray Leaf Spot

Floradel	Manapal
Immokalee	Manalucie
Manalee	

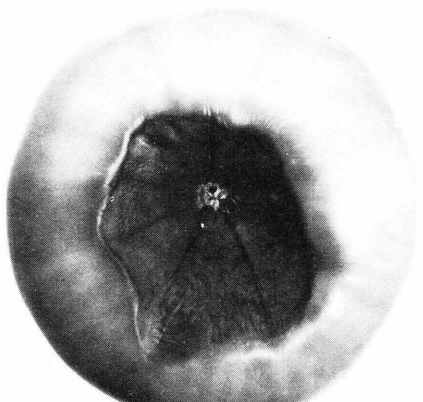
Late Blight

New Hampshire Surecrop	West Virginia 63
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Figure 11.—Tomato showing symptoms of soil rot. Note broken tissue and narrow targetlike markings.



68027

Figure 12.—Tomato showing symptoms of blossom-end rot. Spot is dark, sunken, and leathery.



3517

Figure 13.—Tomato showing symptoms of catface. Note cellular indentation and malformation of tomato.

Seed Treatment

To reduce losses from damping-off and other seed or seedling diseases, coat seed with a fungicide. Use dust of thiram, captan, Ceresan M, or dichlone at the rate recommended by the manufacturer.

Place seed and dust in a tight container; put in no more than enough seed to half fill container. Shake the container 1 or 2 minutes to coat the seeds with dust. Then screen off the excess dust and plant the seed.



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Figure 14.—Tomato leaf showing downward curling that is characteristic of 2,4-D injury.

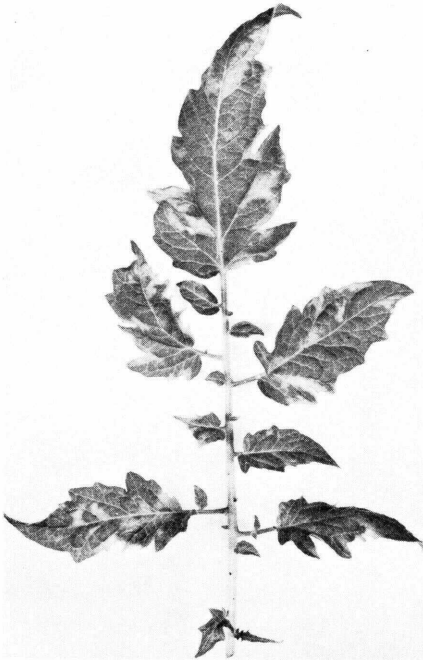
Applying Fungicides

Losses from leaf diseases and many fruit rots can be reduced by applying fungicide sprays or dusts. Sprays are preferable for disease prevention in the home garden; they stick to foliage better than dusts.

Whether you use a spray or a dust, good results can be obtained only if fungicide is applied before a disease is prevalent in the garden and if fungicide thoroughly covers the plants. Begin applications 4 to 6 weeks after transplanting. Continue until harvest.

Apply sprays or dusts at intervals of 7 to 10 days or, during periods of high humidity and rainy weather, at intervals of 4 or 5 days.

A 2- to 3-gallon knapsack sprayer and a fan- or crank-type duster are the most practicable applicators for the home gardener. For more information, see Home and Garden Bulletin 63, "Hand Sprayers and Dusters," available from the U.S. Department of Agriculture, Washington, D.C. 20250. Send your request on a postcard. Please use your Zip code when you order publications.



BN-25873

Figure 15.—Tomato leaf showing mottling (yellow) caused by tobacco mosaic.

Fixed Copper Sprays

The fixed copper compounds include such preparations as basic copper sulfates, copper oxychlorides, copper oxychloride sulfate, and cuprous oxide. These compounds, sold under various trade names, can be used for control of leaf diseases and fruit rots of tomato plants.

Use fixed copper preparations in amounts that give $1\frac{1}{2}$ pounds of copper (calculated as metallic copper) to 100 gallons of water. For smaller quantities, use 1 to $1\frac{1}{2}$ tablespoonfuls to each gallon of water.

The copper content of each preparation is shown on the label and the amount needed can be calculated from this. For example, with a compound containing 50 percent of copper, 3 pounds is needed in 100 gallons of water and 3 tablespoonfuls in 2 gallons of water. With a compound containing 25 percent of copper, 6 pounds would be needed in 100 gallons of water and 6 tablespoonfuls in 1 gallon of water.

Fixed Copper Dusts

Fixed copper dusts usually can be bought from dealers in agricultural supplies. A dust containing 7 percent of actual copper can be used.

Organic Fungicide Sprays

To prepare a spray containing maneb, zineb, or ziram, add $1\frac{1}{2}$ to 2 tablespoonfuls of the fungicide to each gallon of water, or 2 pounds of the fungicide to 100 gallons of water.

To prepare nabam, add 2 quarts of the liquid fungicide to 100 gallons of water, then add 1 pound of zinc sulfate

dissolved in water. For smaller quantities, use 2 tablespoonfuls of nabam and 1 teaspoonful of zinc sulfate for each gallon of water.

Crop Rotation

Crop rotation will not insure freedom from tomato diseases, but it will retard the buildup of disease organisms in the soil.

Do not grow tomatoes in the same soil oftener than once every 3 years, or once every 4 years where bacterial wilt has been prevalent.

Eggplant, peppers, potatoes, and tobacco should not be grown for at least 4 years in any soil that has grown crops infected with bacterial wilt.

Do not plant tomatoes for at least 4 years where stem rot or southern blight has infected beans, beets, cabbage, celery, lettuce, peppers, potatoes, squash, sweetpotatoes, or watermelons.

Names of Fungicides

Names of organic fungicides are referred to in this publication by their common names, not by their chemical names. Some of the common names are trade names.

Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not mentioned.

PRECAUTIONS

Fungicides used improperly can be injurious to man and animals. Chemicals used as fungicides are injurious to man and animals if taken internally; some are very poisonous. Follow directions and heed all precautions on container labels.

Use these chemicals carefully to keep them from getting into the mouth, eyes, or nose. Avoid inhaling chemicals used in dust form. When treating a large quantity of seed with a dust or when dusting plants in the garden, wear a respirator or dust mask. No mask is needed when small quantities of seed are treated in the open air or in a well-ventilated room.

Pour out the unused spray solution where it will quickly sink into the soil. Clean thoroughly all vessels used in preparing a spray solution and plainly label all containers of chemicals. Keep the chemicals locked up or, at least, out of reach of children and animals. Wash clothing and hands after handling chemicals.

Have empty fungicide containers buried at a sanitary land-fill dump, or crush and bury them at least 18 inches deep in a level, isolated place where they will not contaminate water supplies.

The organic fungicides zineb and nabam (used with zinc sulfate) should not be applied to tomatoes within 7 days of harvest.

Information for this publication was furnished by
the Crops Research Division, Agricultural Research Service



Use Pesticides Safely
FOLLOW THE LABEL

U.S. DEPARTMENT OF AGRICULTURE